

The LabVIEW Engine behind ROBOLAB

What does powered by LabVIEW mean? LabVIEW is a powerful programming environment used by engineers and scientists to help with tasks like manufacturing, quality testing and data acquisition. It is a graphical software development tool that allows them to create powerful software applications that assist them in their research or work. During NASA's 1997 Mars Mission, LabVIEW was used to monitor the Sojourner Rover's position and status during its exploration of the planet's surface.

While the power and complexity of LabVIEW is essential for NASA level projects and scientists, children and LEGO components demand less power and a less complicated interface. To fill this need, a special edition of LabVIEW was created to power ROBOLAB. It has fewer options and a user interface that is easy to use.

In the Inventor Level of ROBOLAB there are some core LabVIEW functions that appear. These features, which are not described in the ROBOLAB documentation, are available due to the fact that ROBOLAB is powered by LabVIEW. It is not necessary to use these functions in order to program effectively with ROBOLAB but some of these features can be helpful in programming. However, many of the functions are LabVIEW specific and do not serve any purpose in the ROBOLAB /RCX set-up. These functions are designated with a (*) number sign. If you are interested in advanced programming, it is recommended that you obtain a LabVIEW guide.

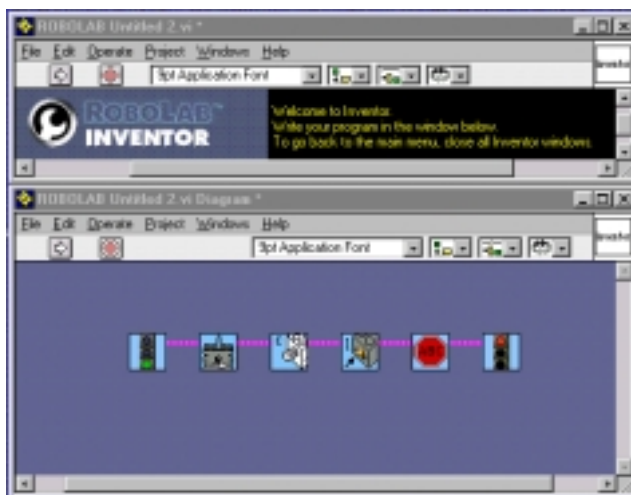
The Inventor level programming has two windows that are open. One is the Panel Window, and the other is the Diagram Window.

Panel Window

The Panel Window is not used in the Inventor programming, but must be open for Inventor to run.

Diagram Window

Programs are created in the Diagram Window.



The Panel and Diagram windows have identical menu bars. The functions associated with each item will be explained, as well as some other features and capabilities available in the Inventor level programming.



Menu Bar

File Menu



The File Menu gives you options for accessing and saving files, printing options, and exiting from the program.

New – Selecting New opens two new windows for a new program on top of existing Panel and Diagram Windows. The new windows have exactly the same icons and information as the two windows that they are covering.

Open – Selecting Open brings up a window that you can use to browse through the computer to find the file you would like to open.



Close – Selecting Close will close the Inventor program that is showing. If there is only one Inventor program open, Close returns you to the Main Programming Menu Screen.

Save – Selecting Save will save your file with its current name to its original location. If you have not previously saved it, the Save As option automatically opens.

Save As – Selecting Save As brings up a window that you can use to select where you would like to save the file, and what name you would like the file to have. Files saved places outside the suggested location may not be visible from the Main Menu.

New VI Library

In addition, there is a button called New VI Library that allows you to create a new VI Library in which to store the file.

What is a VI Library? VI Libraries have the same load, save, and open capabilities as folders and directories. However, your operating system sees them as single files. You can access their contents only from LabVIEW. VI Libraries contain only compressed versions of VIs. In file dialog boxes, a



VI Library appears as a folder or directory icon with an extension of .llb appended to the name.¹

VI Libraries will not appear in the ROBOLAB main menu. They can be accessed from the File Menu in Inventor.

Printer Setup – Selecting Printer Setup brings up a window from which you can select the printer, how many copies you would like, and how it is setup.

Print Window - Selecting Print Window from the Diagram Window will print

- the name of the file,
- the location of the file on the computer,
- the date the file was last modified,
- the time it was printed,
- an image of the program.

This is the typical method for documenting and printing your ROBOLAB programs.

Selecting Print Window from the Panel Window will print the same information but instead of an image of the program, an image of the Panel Window will be printed.

Exit – Selecting Exit brings up a window with the option of Back or Quit. Selecting Back takes you to the Introductory Screen. Selecting Quit will quit ROBOLAB.

Edit Menu



The Edit menu selection gives options for ways to edit the program or items in the Diagram and Panel windows.

Undo – Selecting Undo will undo the last thing that was done. It recognizes if items were moved, deleted, or inserted.

Redo – Selecting Redo will redo the last thing that you undid with the Undo option.

Cut – Selecting Cut will delete whatever item(s) are selected and keep a copy on the clipboard.

Copy – Selecting Copy will copy whatever item(s) are selected to the clipboard.

Paste – Selecting Paste will insert the item(s) from the clipboard to the window.

Clear – Selecting Clear will delete the item(s) that are selected.

¹ Excerpt from LabVIEW Student Edition User's Guide, by Lisa Wells, 1995



Remove Bad Wires – Selecting Remove Bad Wires will delete all the incorrectly attached strings in the program on the Diagram window. These wires are denoted on screen by dashed black and white lines. They can also be removed by using the keyboard shortcuts CTRL-B (PC) or CMD-B (MAC).

Operate Menu



The Operate option has to do with the downloading or aborting of downloading of the ROBOLAB Inventor Level program.

Run – Selecting Run is one of the ways to download the program that is in the Diagram window to the RCX. Choosing the Run option is equivalent to pressing the Run button on the left of the menu bar. If your program has errors or is incomplete, selecting run will bring up the list of problems that your program has (See Broken Run under Menu Icons for further detail)

Stop – Selecting Stop will terminate the download of the program to the RCX.

Project Menu

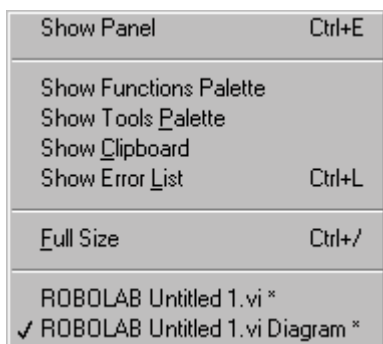


The Project option is a shortcut way to change some of the working conditions of the programming.

Change Inventor Level – Selecting Change Inventor Level brings up a window with the four Inventor Levels. Choosing the one you would like to work with will then open the functions that are available in that level.

Select COM Port – Selecting Select COM Port brings up a window with the options of which COM Port the IR Transmitter is currently attached or Text. Text is used to see the written program logic on the computer screen.

Window Menu



The Window Menu has all the options that control the various windows that can be open. The options on this menu depend on which window you are currently working in (Panel or Diagram)

Show Panel – Selecting Show Panel makes the Panel window visible and your active working window. (Available only from Diagram Window)

Show Diagram – Selecting Show Diagram makes the Diagram window visible and your active working window. (Available only from Panel Window.)



Show Functions Palette – Selecting Show Functions Palette opens the window with the Command Menu Icons in it.

Show Controls Palette – Selecting Show Controls Palette opens the window with the controls palette. This is only an option if the Panel is active instead of the Diagram.

Show Tools Palette – Selecting Tools Palette opens the window with the various tools that can be used in LabVIEW and ROBOLAB programming. The ROBOLAB names, where applicable, appear in ().



What are the items in the Tools Palette used for?



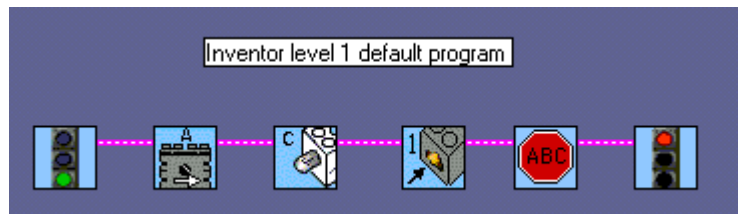
Operate Value (Placement): Selecting this tool allows you to change values that can be displayed on the Panel window.



Position/Size/Select (Select Tool): Selecting this tool allows you to click on an icon and select it. Once it has been selected, clicking and dragging it will move it to another location.



Edit Text (Text Tool): Selecting this tool allows you to insert or edit text boxes in the Panel or Diagram Windows. Click to place the start of the text location, and type the content. If you want to modify existing text, click and drag the tool across the text to highlight it and then type in the new text. Edit Text is useful to create labels for programs.



Connect Wire (String Tool): Selecting this tool allows you to string the icons together.





Object Popup: Selecting this tool provides easy access to modifying settings for items in the Panel or Diagram window. The same option is achieved by right clicking on the item (PC) or Command clicking on the item (MAC). The Object Popup setting options are:



Description: Selecting Description brings up a window with a description of the item selected.

Show: Selecting Show allows you to show or hide the item label and string connection locations.

Replace: Selecting Replace is THE MOST USEFUL option. It opens the Function window and allows you to select a new icon to replace the current one, without having to go through the process of deleting, placing a new one, and then stringing it into the sequence.

Cluster Tools*: Selecting Cluster Tools allows you to combine or break apart the information in bundles of strings. Clusters are used in ROBOLAB to pass information from command to command. This is used in advanced level programming.

Array Tools*: Selecting Array Tools allows you to manipulate data that is contained in the strings. The RCX cannot make use of the arrays so this is used in advanced level LabVIEW programming.

Create Constant*: Selecting Create Constant generates a constant value at the specified location. This is used in advanced level programming.

Create Control*: Selecting Create Control generates a control item at the specified location in the program. This is used in advanced level programming.

Create Indicator*: Selecting Create Indicator generates an indicator item at the specified location in the program. This is used in advanced level programming.

Open Front Panel: Selecting Open Front Panel displays the Panel Window and makes it the active window.

* LabVIEW feature with no functional use on ROBOLAB





Scroll Window: Selecting this tool allows you to click on the Panel or Diagram window and move it within the open window space.



Set/Clear Breakpoint*: Selecting this tool allows you to put a suspension in the execution of your program. This is used in advanced level programming.



Probe Data*: Selecting this tool allows you to probe the program for values along the string. This is used in advanced level programming.



Get Color: Selecting this tool allows you to copy a color from an image in order to use it as part of the color palette. This is used in advanced level programming.



Set Color: Selecting this tool allows you to set colors of objects in the Panel and Diagram windows. This is used in advanced level programming.

Show Clipboard – Selecting Show Clipboard opens a window that shows the current contents of the image or text in memory.

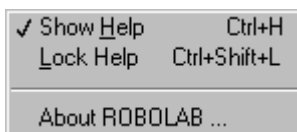
Show Error List – Selecting Show Error List brings up the LabVIEW error window with the programming errors for the program in the Diagram window.

Full Size – Selecting Full Size from the Diagram Window Menu will make the Diagram window fill the screen. Selecting Full Size from the Panel Window will make the Panel window fill the computer screen.

ROBOLAB filename.vi – Selecting ROBOLAB filename.vi brings the Panel window of the program filename to the front as the active ROBOLAB program and window.

ROBOLAB filename.vi Diagram – Selecting ROBOLAB filename.vi Diagram brings the Diagram window of the program filename to the front as the active ROBOLAB program and window.

Help



The Show Help option is used to view on screen help for the Inventor Level programming.

Show Help – Selecting Show Help opens the help window. If the help window is open, selecting Show Help will close the Help window.

* LabVIEW feature with no functional use on ROBOLAB



Lock Help – Selecting Lock Help keeps the information displayed in the help window from changing as you move the cursor around the screen.

About ROBOLAB – Selecting About ROBOLAB brings up a window that gives you a little bit of information about all the cool places that helped in the development of ROBOLAB.

Menu Icons

Run



The Run button can be used to begin the download of the Inventor program to the RCX via the IR Transmitter. Clicking on this button is equivalent to opening the Operate Menu and selecting Run.

Broken Run When the run button appears as a broken



arrow that means that your program is incomplete or has an error. Clicking on the broken run button will bring up a list of problems with your program. Clicking once on the error and then on the Find button will highlight the problem area or icon in your program



Abort Run

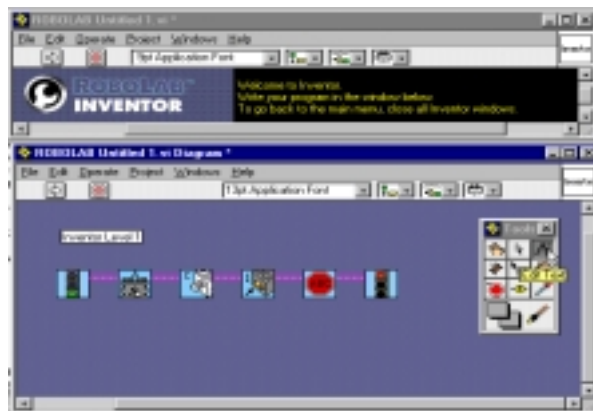


The Abort Run button can be used to end the download of the Inventor program from the computer to the RCX. Clicking on this button is equivalent to opening the Operate Menu and selecting STOP.

Text Settings

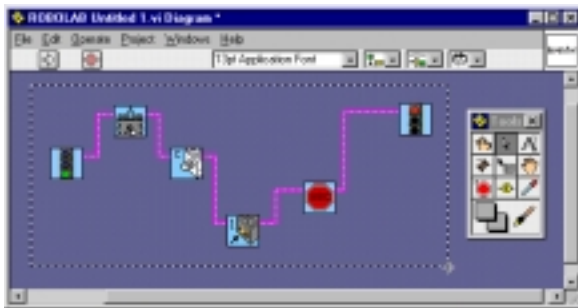
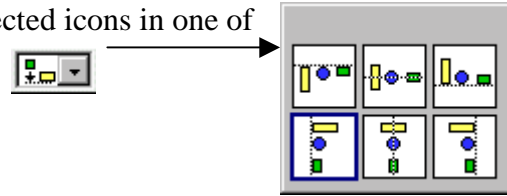


The Text Settings is a drop down menu that allows you to modify the size, style, color, and font of text in text boxes.

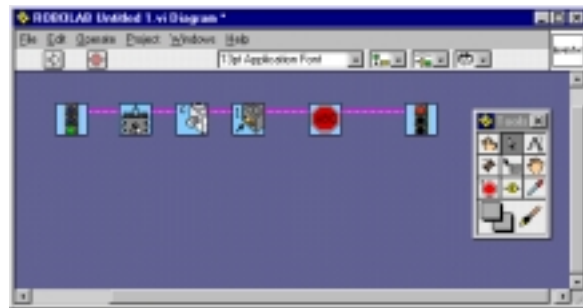


The text can be changed in the Panel or Diagram by highlighting it with the text tool and the selecting settings from the Text Setting drop down menu. Text changes are saved with users programs and do not alter the original templates for the Inventor Level Programs.

Align The Align icon allows you to easily align selected icons in one of six pre-set formats.



Before Top Edge Alignment

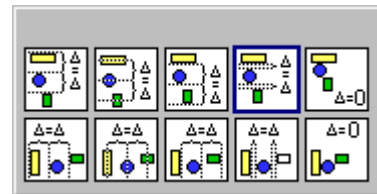


After Top Edge Alignment

Distribute



The Distribute icon allows you to easily distribute icons in one of ten pre-set formats.



Before Horizontal Gap Distribute



After Horizontal Gap Distribute

Reorder*



The Reorder icon allows you to change the order that items are 'layered' in your Panel or Diagram windows. Layering only occurs in some very advanced programming situations.

Move Forward	Ctrl+K
Move Backward	Ctrl+J
Move To Front	Ctrl+Shift+K
Move To Back	Ctrl+Shift+J

* LabVIEW feature with no functional use on ROBOLAB



The icon associated with your program can be modified with an image of your choosing. To do this, right click on the icon image on the right end of the menu bar(PC) or command click on the right end of the menu bar (MAC). Selecting the edit icon option will bring up a window that allows you to create your own icon image that will be saved with your program. You have the option of a Black and White icon, or an icon based on 16 or 256 colors. Selecting which type you would like, and then working with the drawing and text options shown on the left side of the window will allow you to create the new icon image.

Exiting Inventor

Upon exiting inventor the “Save Changes” dialogue Box appears. If you have made changes to a program that you would like to keep choose “Yes.” To exit Inventor without saving the changes select “No.” If you wish to see what changes were made select “Explain.” If you do not wish to exit Inventor select “Cancel” and you will be returned to programming. Any changes you make will be saved to a new file and will not alter the original template for an Inventor Level in anyway.

